REMARKS/ARGUMENTS

The Office Action mailed January 26, 2005 has been carefully considered. Reconsideration in view of the following remarks is respectfully requested.

Claim Status and Amendment to the Claims

Claims 1-53 are now pending. The Examiner's attention is drawn to a preliminary amendment filed February 16, 2001, by which new dependent claims 46-53 were added.

Claims 2-14, 17-21, 25-33, 35-38, 40-53 have been withdrawn from consideration as being drawn to a non-elected species as the result of an earlier restriction requirement. Thus, Claims 1, 15-16, 22-24, 34 and 39 are under consideration.

Claim 1 has been amended to further particularly point out and distinctly claim subject matter regarded as the invention.

The text of claims 22-24 is unchanged, but their meaning is changed because they depend from amended claims.

The 35 U.S.C. §103 Rejections

Claims 1, 15, 16 and 22-24 stand rejected under 35 U.S.C. 103(a) as being allegedly unpatentable over U.S. Pat. No. 6,147,786 (*Pan*). Claims 34 and 39 also stand rejected under 35 U.S.C. 103(a) as being allegedly unpatentable over Pan in view of U.S. Statutory Invention Registration No. US H2075 H (*Gnauck*). These rejection is respectfully traversed.

According to M.P.E.P. §2143,

> To establish a *prima facie* case of obviousness, three basic criteria must be met. First there must be some suggestion or motivation, either in the references themselves or in the knowledge generally available to one of ordinary skill in the art, to modify the reference or to combine reference teachings. Second, there must be a reasonable expectation of success. Finally, the prior art reference (or references when combined) must teach or suggest all the claim limitations. The teaching or suggestion to make the claimed combination and the reasonable expectation of success must both be found in the prior art, not in the applicant's disclosure.

Furthermore, the mere fact that references can be combined or modified does not render the resultant combination obvious unless the prior art also suggests the desirability of the combination. *In re Mills*, 916 F.2d 680, 16 USPQ2d 1430 (Fed. Cir. 1990).

Regarding Claims 1 and 15

Claim 1, as amended, defines an optical wavelength division multiplexing network having a structure comprising at least three layers, highest level network, an intermediate level network, and a lowest level network. The highest level network is a ring network which comprises at least one center node and two or more remote nodes which are joined by at least two optical fibers, the intermediate level network comprises a ring having said node belonging to the highest level network as its center node, nodes belonging to said ring network being joined by at-least two optical fibers, and the lowest level network comprises a star network centered around an access node which multiplexes traffic from one or a plurality of optical network units (ONU), said ONU and said access node being directly joined by at least one optical fiber. Said remote nodes amplifies optical wavelength division multiplexing signals which are transmitted on an

optical fiber comprising the higher level network which said remote nodes belong to, branches the signals to an optical fiber comprising the lower level network, and couples optical wavelength division multiplexing signals, input from an optical fiber comprising the lower level network, to optical wavelength division multiplexing signals transmitted on an optical fiber comprising said higher level network, and amplifies the coupled signals, as recited in Claim 1. Furthermore, said access node amplifies the optical wavelength division multiplexing signals transmitted from said optical fibers which comprise the higher level network which said access node is connected to, selects optical signals having wavelengths which correspond to said ONU, and outputs the selected signals to said ONU; multiplexes said optical signals transmitted from said ONU, divides the multiplexed signals in a plurality of directions, amplifies the divided signals, and transmits the amplified signals to an optical fiber comprising a higher level network which said access node is connected to. In addition, the center node belonging to said highest level network and said ONU establishes a direct communication path by using lights of different wavelengths, the optical signals being amplified, branched, and routed at said remote nodes and said access node provided therebetween, as recited in Claim 1.

Claim 15 recites substantially the same distinctive features as Claim 1.

According to the claimed invention as recited in Claims 1 and 15, a *direct* communication path is established between a center node belonging to the highest level network and an ONU connected to the lowest level network, and a remote node and an

access node provided between the center node and the ONU amplify, branch, couple, and route optical signals without signal termination (*emphasis* added).

In this respect, *Pan* states that the "next generation of optical networks are being made using optical routers and switching elements to allow all-optical light paths to be set up from a source node to a destination node, thus bypassing electronic bottlenecks at intermediate switching nodes" (column 2, last line to column 3, line 4 thereof). However, as can be understood from the description in column 3, lines 15-34 and 45-51, for example, *Pan* considers such a high-bandwidth, high-throughput optic fiber network or a Fiber To The Curb (FTTC) network architecture as not cost-effective, and proposes an alternative low-cost solution of hybrid analog/digital wavelength division multiplexing (WDM). Thus, *Pan* teaches away from employing such a next generation networks with all-optical light paths bypassing electronic bottlenecks.

In the Office Action, although the Examine admits that *Pan* "does not describe his invention in terms of intermediate layers," the Examiner alleges that one of ordinary skill in the art at the time of invention would consider the Pan's first ring (Super Trunk including a Master HE & DXC) network a highest level network, Pan's second ring (Trunk including a secondary HE & TM) network an intermediate ring and the ONU network a lowest level network based on a progression of signals from the end user to the Master HE & DXC shown in Figure 1" (Office Action, page 4, lines 10-14). The Applicants respectfully disagree for the reasons set forth below.

First, FIG. 1 of *Pan* merely discloses a two-layer network including two higher-level ring networks having a similar configuration and an "access network" including ONUs having a star configuration. That is, unlike the invention as recited in Claims 1 and 5, *Pan* fails to disclose or suggest an intermediate ring network, as the Examiner admits (Office Action, page 4, line 10). It should be noted that *Pan*'s network headends, "Master HE & DXC", "Primary Headend (HE) & Central Office (CO)", and "Secondary HE & TM" (FIG. 1, column 8, lines 3-18 thereof) have similar function, as discussed below, and the alleged first ring (Super Trunk) and the alleged second ring (Trunk) of *Pan* both belong to the same higher level network. In addition, *Pan* fails to disclose or suggest a structure in which both a remote node and an access node are provided between the center node and the ONU.

Furthermore, even if *Pan*'s access network might correspond to the lower network of the claimed invention, as the Examine alleges, *Pan*'s feeder/de/multiplexer **28** (alleged access node) converts optical analog signals with wavelength λ_1 into electrical signals (e.g., see column 3, lines 61-62, column 4, lines 24-26, column 9, lines 2-3 thereof), and thus *Pan*'s alleged access node performs electrical processing of the optical signals. This is necessary for *Pan* because *Pan* employs the analog/digital hybrid structure involved with the lower-level access network including the ONU (e.g., column 9, lines 2-3 and 19-21 thereof) to achieve its objectives. Thus, Pan also fails to disclose or teach the claimed access node at which the optical signals are only amplified, branched, or routed.

Regarding the structure of the headends (alleged remote nodes) including the first or second ring, *Pan* only describes that a primary HE & CO may drop or add signals (column 8, lines 11-13 thereof). *Pan* is silent about the detailed structure of the headends. Therefore, the Applicants respectfully asserts that the headends of *Pan* employ a conventional structure which is provided with equipment for signal termination that performs electrical processing in the same manner as conventional nodes as described in FIG. 25 of the present application. That is, Pan also fails to disclose or teach the claimed remote nodes at which the optical signals are only amplified, branched, or routed.

In view of the foregoing, it is respectfully submitted that *Pan* does not render the claimed invention as recited in Claims 1 and 15 obvious.

Regarding Claim 34

Claim 34 defines a node apparatus in an optical network comprising at least two layers. The claimed node apparatus is connected to a network immediately above a lowest level network establishing a direct communication path with optical network units (ONU) and transmitting data by using optical signals at wavelengths allocated to each of said ONU, said ONU transmitting the data to the node apparatus connected to a network provided higher level than said lowest level network by optical signals at wavelengths which are different to the wavelengths. The node apparatus is also connected to said lowest level network, and comprises (a) an optical switch which selects one of the optical signals which are input from optical fibers comprising a higher level network, (b) a first optical amplifier which amplifies, among the optical signals which are input from the

optical fibers comprising said higher level network, at least the optical signal selected by said optical switch, (c) an optical multiplexer/de-multiplexer which, based an the optical signal selected by said optical switch, selects an optical signal having a wavelength which corresponds to said ONU, outputs the selected signal to said ONU, and multiplexes the optical signals transmitted from said ONU, (d) an optical divider which divides the optical signal, multiplexed by said optical multiplexer/de-multiplexer, into a plurality of directions, and transmits the divided signals to the optical fibers comprising said higher level network, and (e) a second optical amplifier which amplifies the optical signals which are transmitted to the optical fibers comprising said higher level network, as recited in Claim 34.

The claimed node apparatus recited in Claim 34 corresponds to an access node. As explained above with respect to Claims 1 and 15, *Pan* fails to disclose or suggest a node apparatus corresponding to an access node.

In addition, *Gnauck* merely discloses a remote node (e.g., reference number **350a** shown in FIG. 3 thereof), and *Gnauck* fails to disclose an access node. Although the Examiner may assert that the remote node of *Gnauck* corresponds to the access node since the remote node of *Gnauck* directly communicates with ONUs, *Gnauck* fails to disclose or suggest the detailed structure of the node apparatus as recited in Claim 34 for the reasons set forth below.

FIGS. 30-34 of *Gnauck* illustrate the detailed structure of remote nodes (RNs). Each of the remote nodes shown in FIGS. 30, 31, 33 and 34 consists of only a wavelength grating router (WGR) which merely multiplexes and demultiplexes optical signals. In contrast, the claimed node apparatus as recited in Claim 34 includes an optical switch, an optical divider, and first and second optical amplifiers, in addition to an optical multiplexer/de-multiplexer. Such a structure allows switching between a working fiber and a protection fiber. Therefore, FIGS. 30, 31, 33 and 34 of *Gnauck* do not render the claimed node apparatus as recited in Claim 34 obvious.

FIG. 32 of *Gnauck* is provided with optical couplers **3275** and **3285** in addition to a WGR **3200**. However, the claimed node apparatus as recited in Claim 34 further includes the optical switch and the first and second optical amplifiers which are neither taught nor suggested by FIG. 32 of *Gnauck*. FIG. 32 of *Gnauck* is merely involved with the structure in which a central office (CO) selects an optical fiber **3220a** or **3220b** (see column 24, lines 12 to 15 of *Gnauck*) to which an optical signal is transmitted. Therefore, FIG. 32 of *Gnauck* cannot be applied to the configuration in which the selection between working and protection optical fibers is performed at a node apparatus connected to the lowest level network (an access node) rather than at a node apparatus belonging to the highest level network (a center node).

In view of foregoing, it is respectfully submitted that the alleged combination of *Pan* and *Gnauck* does not render the claimed node apparatus as recited in Claim 34 obvious.

Regarding Claim 39

Claim 39 defines a node apparatus in an optical network comprising at least two layers. The claimed node apparatus, which is connected to a highest level network and becomes the final multiplexing destination of traffic, establishes a direct communication path to optical network units (ONU) and transmits data by using optical signals at wavelengths allocated to said ONU, said ONU transmitting data by using optical signals at same wavelengths as said wavelengths to said node apparatus which becomes the final multiplexing destination of traffic. The claimed node apparatusbecomes the final multiplexing destination of traffic, and comprises (a) a plurality of optical de-multiplexers which de-multiplex optical wavelength division multiplexing signals, input from optical fibers comprising said highest level network, to optical signals at each wavelength, (b) a plurality of optical receivers which convert the optical signals which have been de-multiplexed by said optical de-multiplexers to electrical signals, (c) a plurality of selectors which selectively output either of the outputs from said plurality of optical receivers, (d) a signal termination section which performs predetermined electrical processing to the electrical signals which have been selected by said selectors, and outputs a plurality of groups of electrical signals, (e) a plurality of optical senders which convert the electrical signals output from the signal termination section to a plurality of optical signals having different wavelengths, and (f) a plurality of optical multiplexers which multiplex the optical signals output from said optical senders, and output the multiplexed signals to optical fibers comprising said highest level network.

The claimed node apparatus recited in Claim 39 corresponds to a center node, and the claimed node apparatus includes a plurality of optical demultiplexers, a plurality of optical multiplexers, and a plurality of selectors, as recited above. Such a structure makes it possible to select optical signals which are respectively supplied from a working fiber and a protection fiber. In contrast, FIG. 26 of *Gnauck* pointed out by the Examiner merely uses optical fibers **2610** and **2615** for downstream and upstream communications, respectively. Therefore, FIG. 26 of *Gnauck* cannot be applied to the configuration in which a working fiber and a protection fiber are provided.

In addition, *Gnauck* states that the receiver **2850** and the laser **2860** of FIG. 28 may be configured as those shown in FIG. 26 (column 21, lines 36-50 thereof). However, the invention as recited in Claim 39 demultiplexes an optical wavelength division multiplexing signal, converts demultiplexed optical signals into electrical signals, and then selects one of the electrical signals. In addition, the claimed node apparatus as recited in Claim 39 multiplexes optical signals and transmits the multiplexed optical signal to an optical fiber without selecting any optical signals. In contrast, FIG. 28 of *Gnauck* selects one of the optical fibers, demultiplexes an optical signal transmitted through the selected optical fiber, and receives the demultiplexed optical signals. In addition, FIG. 28 of *Gnauck* multiplexes optical signals, selects one of the optical fibers, and transmits the multiplexed optical signal to the selected optical fiber. In this way, FIG. 28 of *Gnauck* is different from the invention as recited in Claim 39. In addition, FIG. 28 of *Gnauck* cannot be applied to the configuration in which the selection between working and protection optical fibers are performed at a node apparatus connected to the

lowest level network (an access node) rather than at a node apparatus belonging to the highest level network (a center node).

In view of foregoing, it is respectfully submitted that the combination of *Pan* and *Gnauck* does not render the claimed node apparatus as recited in Claim 39 obvious.

Accordingly, it is respectfully requested that the rejection of claims based on *Pan* and *Gnauck* be withdrawn. In view of the foregoing, it is respectfully asserted that the claims are now in condition for allowance.

Dependent Claims

Claims 22-24 depend from Claim 1, Claim 16 depends from Claim 15, and thus include the limitations of Claim 1 and 15, respectively. The argument set forth above is equally applicable here. The base claims being allowable, the dependent claims must also be allowable at least for the same reasons.

In addition, the dependent claims are also allowable for the reasons set forth below.

Regarding Claim 16

In the Office Action, the Examiner asserts that column 5, lines 1-15, of *Pan* discloses at least four optical fibers. However, the Applicant respectfully disagree.

As recited in the second paragraph of Claim 16, the access nodes and remote nodes do not comprise optical multiplexer/de-multiplexers having wavelength selectability, but the ONUs themselves have a wavelength de-multiplexing function. In contrast, as shown in FIG. 1 of *Pan*, an optical signal of a single wavelength which has been demultiplexed at a feeder/de/multiplexing point **28** is transmitted to each of mini-digital optical nodes **36a** to **36d**. *Pan* fails to disclose or suggest the structure of Claim 16 in which the ONUs themselves demultiplex optical signals.

Therefore, it is respectfully submitted that *Pan* does not render the invention as recited in Claim 16 obvious for these additional reasons.

Regarding Claims 22 and 24

The claimed invention as recited in Claims 22 and 24 doubles communications between an ONU and access nodes by using radio communications. The Examiner asserts that *Pan* discloses communication between an ONU and access nodes simultaneously in both analog and digital format, and the video signal is understood to be a radio signal.

However, in *Pan*, the analog signal (see wavelength λ_1 shown in FIG. 1 thereof) is converted into an electrical signal and the converted electrical signal is broadcast to users **24** via a coax cable **42** (column 9, lines 2-4 thereof), while digital signals (see wavelength λ_2, λ_3, ... shown in FIG. 1 thereof) are transmitted to the mini-digital optical nodes **36a** to **36d** using different wavelengths as shown in FIG. 1 of *Pan*. In *Pan*, information

transmitted via the analog signal is different from information transmitted via the digital signal. Therefore, *Pan* fails to disclose or suggest the doubling of communications.

In addition, *Pan* connects a headend **20** with the mini-digital optical nodes **36a** to **36d** via optical fibers and the coax cables **42**. *Pan* employs wired communication between the headend **20** and the mini-digital optical nodes **36a** to **36d**, and thus fails to disclose or suggest radio (wireless) communications.

Therefore, it is respectfully submitted that *Pan* does not render the invention as recited in Claims 22 and 24 obvious.

In view of the foregoing, it is respectfully asserted that the claims are now in condition for allowance.

Conclusion

It is believed that this Amendment places the above-identified patent application into condition for allowance. Early favorable consideration of this Amendment is earnestly solicited.

If, in the opinion of the Examiner, an interview would expedite the prosecution of this application, the Examiner is invited to call the undersigned attorney at the number indicated below.

The Commissioner is hereby authorized to charge any fees which may be required, or credit any overpayment, to Deposit Account Number 50-1698.

Respectfully submitted,
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Limited Recognition under 37 CFR §10.9(b)

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